6.7 HEALTH RISKS AND MORTALITY

The WCEP Health Team has primary responsibility for coordinating clinical assessment and health evaluation from egg through death, opportunistic health monitoring, and treatment of all wild cranes in the eastern population. Veterinary network cooperators are available to provide field assistance when a Health Team member is unavailable. Contact the WI DNR wildlife veterinarian or the ICF veterinarian for health assessments and urgent health care issues within Wisconsin.

Field biologists and/or the WI DNR whooping crane coordinator will provide the Health Team with timely updates of current cases and facilitate requests for assistance. All efforts will be made to contact the consulting veterinary staff with a change in health status. Evaluations of wild whooping cranes will be coordinated with the Health Team, and decisions on intervention will be made by the consulting veterinarian. When possible, adequate lead time will be provided to arrange for Health Team personnel presence during radio transmitter changes or other capture/relocation events.

Short-term treatment facilities may be used. Diagnostic work-ups and procedures—under strict isolation protocols—may occur at the Necedah NWR acute care facility or ICF veterinary quarantine facility. The goal of treatment is reestablishment of the affected crane into the wild as soon as medically possible. Birds needing additional care will be removed from the project and transferred to the Milwaukee County Zoo or other approved facility for intermediate-term care and management. As described below, wild cranes may experience infectious and non-infectious diseases, predation, human disturbance, and power line or other fixed structure collisions.

Any incident involving the injury, death, or possession of a whooping crane should be reported to the conservation warden in the relevant county. Reports may be made directly to the warden or through the nearest WI DNR Service Center, sheriff's department, or by calling the WI DNR violation hotline at 1-800-TIP-WDNR (847-9367). Wardens will document the report and subsequent investigation on a law enforcement complaint form (Form #4800-48). (Refer to Appendix 8, Response Protocols, for a sample of the "Dead Crane Data Sheet".)

As soon as practical after receiving a report the warden or the warden supervisor will notify the Regional Enforcement and Science leader and the Bureau of Endangered Resources. The investigating state warden will coordinate the investigation with the USFWS federal warden as appropriate on all intentional shootings. Any unlawfully killed or possessed whooping crane carcass will be tagged by the warden with a seizure record tag (Form # 4100-190). Proper chain of custody will need to be maintained for any incidents that might result in enforcement action.

6.7.1 Diseases

The AWBP and the extirpated Rocky Mountain population frequently experienced infections with avian mycobacteriosis (*Mycobacterium sp*.). Approximately 39 percent of AWBP birds necropsied were diagnosed with mycobacteriosis/tuberculosis (Friend & Franson, 1999). Captive cranes may be particularly susceptible, although no confirmed cases occurred in the captive populations contributing chicks to the release programs. Screening of birds prior to release should prevent the introduction of tuberculosis into the

eastern population; however, postmortem evaluation should continue to record the possible occurrence of this disease from wild sources.

Aspergillosis (*Aspergillus fumigatus*) is a common fungal infection usually existing as a secondary problem in a debilitated bird. Most aspergillosis outbreaks occur in fall to early winter, particularly among birds stressed by crippling, oiling, malnutrition, recent capture, environmental contaminants, and concurrent disease conditions (Friend & Franson, 1999). So far, only the FP has recorded cases of asperigillosis.

Mycotoxins are non-infectious toxic compounds produced by fungi (i.e., *Aspergillus sp*. and *Fusarium sp.*) that typically occur in moldy grain, such as corn and peanuts. Wild sandhill cranes mortalities resulted from two types of mycotoxin poisoning, aflatoxicosis and fusariotoxicosis. Most mortality due to toxic levels of these compounds occurs when cranes consume waste grain during fall migration and wintering (Friend & Franson, 1999). Mycotoxin poisoning can also occur when contaminated grain is offered at feeding stations.

Whooping cranes are highly susceptible to the mosquito transmitted eastern equine encephalomyelitis (EEE) virus of eastern and north-central North America. In1984, the disease killed seven captive whooping cranes at the Patuxent Wildlife Research Center, one of the facilities supplying crane chicks for reintroduction (Dein et al., 1986). In 2004, one unvaccinated EMP crane died of EEE near the end of its ultralight-led fall migration. Currently, all captive-reared juvenile whooping cranes are vaccinated against EEE prior to release using a commercially available equine vaccine. The efficacy of the vaccine is unknown for whooping cranes; therefore, disease exposure should be monitored through blood sample and crane mortality analysis.

Disseminated visceral coccidiosis (DVC) is an extra-intestinal form of parasitism by protozoal *Eimeria*. Affecting captive and wild whooping cranes, the pathology of this disease can range from mild to severe. The disease is common among sandhill cranes in Wisconsin and at the Patuxent Wildlife Research Center. Juvenile whooping cranes are highly susceptible to DVC; consequently, the EMP and FP's diet is supplemented with the coccidiostat drug, monensin. The drug limits infections to promote an immune response that prevents disease. The effect of this treatment and the impact of DVC on whooping crane survival after release are unknown. Lesions consistent with DVC were observed in some cranes, however, they were not identified as the cause of death.

Whooping cranes can be infected with endoparasites, including acanthocephalans, cestodes, trematodes, and nematodes (Carpenter, 1993). The effect of endoparasites on wild and captive crane survival is unclear. Significant morbidity and mortality due to endoparasitism occurred prior to the release of juvenile cranes into the Florida and eastern populations. Parasite monitoring will become increasingly important as young are recruited into the population.

Avian botulism, a paralytic disease caused by the ingestion of *Clostridium botulinum* biotoxin, is found throughout the eastern migratory Flyway used by whooping cranes. Though not considered a species at risk, whooping cranes could be exposed during a large outbreak in remote areas. Control strategies (i.e., carcass removal and avoidance of water draw-downs in botulism prone areas during warm weather) will reduce the likelihood of whooping crane exposure.

6.7.2 Contaminants

Though cranes usually feed on lower trophic levels, they are long-lived and may accumulate significant amounts of persistent chemicals (Olsen, Langenberg, & Carpenter, 1996). A sampling of whooping crane carcasses and eggs indicated declining DDT pesticide and mercury levels, while other related compounds such as chlorinated hydrocarbons persisted at low levels (Lewis et al., 1992b). Trace elements including aluminum, arsenic, cadmium, chromium, copper, selenium, and zinc were found at levels high enough to justify further monitoring. Although organophosphate and carbamate compounds have been identified in sandhill crane tissue (Olsen et al., 1996), the impact of these chemicals on whooping cranes is unknown.

Consumption of non-food items for grit is a risk factor for heavy metal toxicosis. Lead fishing weights and spent shot, small wire clippings, and zinc alloy coins are only a small number of potential sources of heavy metals that may be ingested by wild whooping cranes.
For example, lead poisoning occurred in a whooping crane following ingestion of a plastic encased battery or fish sinker (Snyder, Richard, Thilsted, Drewien & Lewis, 1992). Zinc toxicosis is a recognized mortality factor in the Florida non-migratory population.

6.7.3 Traumatic Injury and Death

Traumatic injury may impact individual crane survival, and ultimately threaten the existence of the small Florida and eastern populations. The causes of traumatic injury can be divided into natural events such as predation and severe weather, and anthropogenic causes like contact with humans or human artifacts.

Whooping cranes are preyed upon by both mammalian and avian predators. Bobcat (*Felis rufus*) predation is the most frequent cause of death for Florida cranes. Furthermore, predation is suspected as the cause of death in at least six EMP whooping cranes. Though underlying disease or injury can predispose an animal to predation, management steps may be available to limit the potential impact of predators on healthy individuals in sensitive areas (refer to Trapping, Section 7.2).

Litter such as fishing line, spent shot gun shell casings, and aluminum cans often harm cranes. The risk to whooping crane survival increases as the foreign material wounds or constricts blood flow to critical areas, such as around the beak, limb, or digit. Public awareness regarding the dangers of litter and spent tackle to whooping cranes and other wildlife should be promoted.

The accidental shooting death of two AWBP whooping cranes in Kansas (2004) and an EMP whooping crane in Alabama (2004) illustrates the need to educate the public on proper field identification of whooping cranes. To prevent gunshot injury and mortality during hunting season, in 2005, Texas Parks and Wildlife produced a training DVD entitled, “Be Sure Before You Shoot” that includes whooping crane identification tips (refer to Legal Aspects, Section 4.1, and Appendix 8)

6.7.4. Collisions with Power Lines, Towers, Turbines and Other Structures

Collisions with power lines are a significant cause of whooping crane mortality during migration (Brown, Drewien, & Bizeau, 1987; Lewis et al., 1992a). Cranes often hit power lines after being flushed or disturbed from a roost. To remedy a persistent problem in areas of Florida, in 2004 Progress Energy (the owner of the lines) marked the top “static”

smaller diameter lines (typically most problematic for birds to see and avoid) with yellow spiral visibility markers. In June 2005, Progress Energy increased the number of marked lines using a potentially more effective marker (Firefly Bird Flapper by PR Technologies, Portland, Oregon).

Additional power line construction throughout the principal migration corridor will increase the potential for collision mortalities. To address this issue, in 1989 the Avian Power Line Interaction Committee (APLIC)—composed of nine investor-owned electric utilities and the USFWS—was established to protect cranes in the AWBP Flyway (Lewis, 1997). In 1994, APLIC provided voluntary industry guidelines on avoiding power line strikes. Presently, the USFWS is working on memorandums-of-understanding (MOUs) that call for the development of avian protection plans by participating companies (Manville, in press). Tests of line marking devices using sandhill cranes identified techniques effective in reducing collisions up to 61 percent (Morkill, 1990; Morkill & Anderson, 1991, 1993; Brown & Drewien, 1995). Techniques currently recommended include marking lines in frequently used areas, and avoiding new line corridors near wetlands or other crane use areas.

Whooping cranes may also be injured or killed through wind turbine collisions. In the next decade the number of wind turbines may increase from 15,000 to 31,000 (Manville, in press). Of special concern is the development of wind farms in the whooping crane migration corridor. Cranes could die by either striking wind turbines, or by colliding with new power lines associated with wind farm development. Management and research are needed to reduce this new threat.

Increasing numbers of power lines, communication towers, and wind turbines may kill as many as 225 million birds annually in the U.S. (Manville, in press; CWS & USFWS, 2006). Recently, seventeen Florida cranes and two EMP cranes died by hitting power lines. In the 1980s, two of nine radio-marked AWBP whooping cranes collided with power lines and died within the first 18 months of life (Kuyt, 1992). Since 1956, power line collisions caused the death or serious injury of at least 41 whooping cranes.

Specifically, eight Florida cranes died after striking high-voltage transmission lines and nine Florida cranes died by hitting lower voltage local distribution lines (Folk et al., 2006). Seven mortalities took place in a two-year period (March 2003 to March 2005) along an 8 km span of high-voltage lines. The birds were roosting on one side of the line and feeding on the other, thus crossing the lines at least twice daily.

Five Florida birds collided with lines and survived. (Based on recovery of transmitters with broken leg bands under power lines, and subsequent observations of the birds that carried those transmitters.) It is not unusual to see whooping cranes brush power lines or trees with their legs. As the bird brushes the object, the transmitter, which hangs down on the leg, is likely struck hard enough to shatter the plastic band.

Guy wires associated with telecommunication towers present another collision obstacle. Increasing at an estimated 6 to 8 percent annually, the Federal Communication Commission's (FCC) 1999 Antenna Structure Registry listed 48,000 lighted towers over 60.7 m above ground level and over 68,000 towers total in the United States. An estimated 24 to 38 percent of the towers were improperly registered with the FCC. The future requirement that television stations must be digitized may add an additional 1,000 towers exceeding 305 m in height.

6.8 MANAGING PUBLIC AND PRIVATE LANDS

Any wetland with minimal human disturbance, even small isolated wetlands, bears potential for use by whooping cranes (Fig. 13). However, it is expected that the locations of initial high concentration and nesting will occur in the primary rearing and release location of central Wisconsin: at Necedah National Wildlife Refuge in Juneau County and surrounding wetlands of Monroe, Jackson, Wood, Marathon, Adams, and Marquette Counties. (See Appendix 6 for a description of observed whooping crane locations within each county).

Between 2002 and 2005, cranes were observed in 32 of 72 counties, primarily along major rivers and wetlands in central and southern Wisconsin (Appendix 6). Sometimes whooping cranes associate with pre-migratory sandhill crane flocks. Autumn sandhill crane staging areas may predict whooping crane habitat use (Fig. 14).

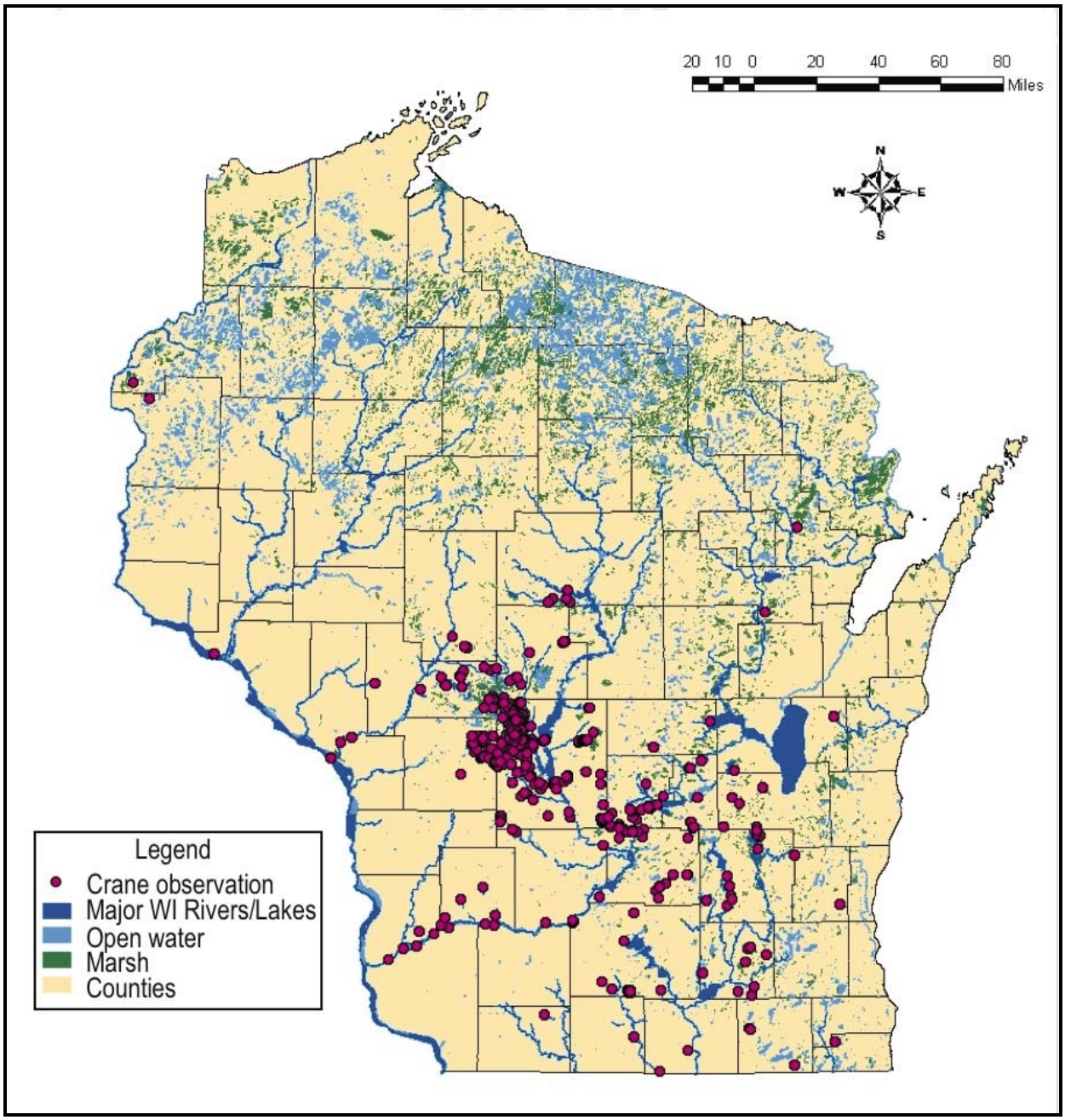

Figure 13. Whooping crane observed locations, 2002-2005.

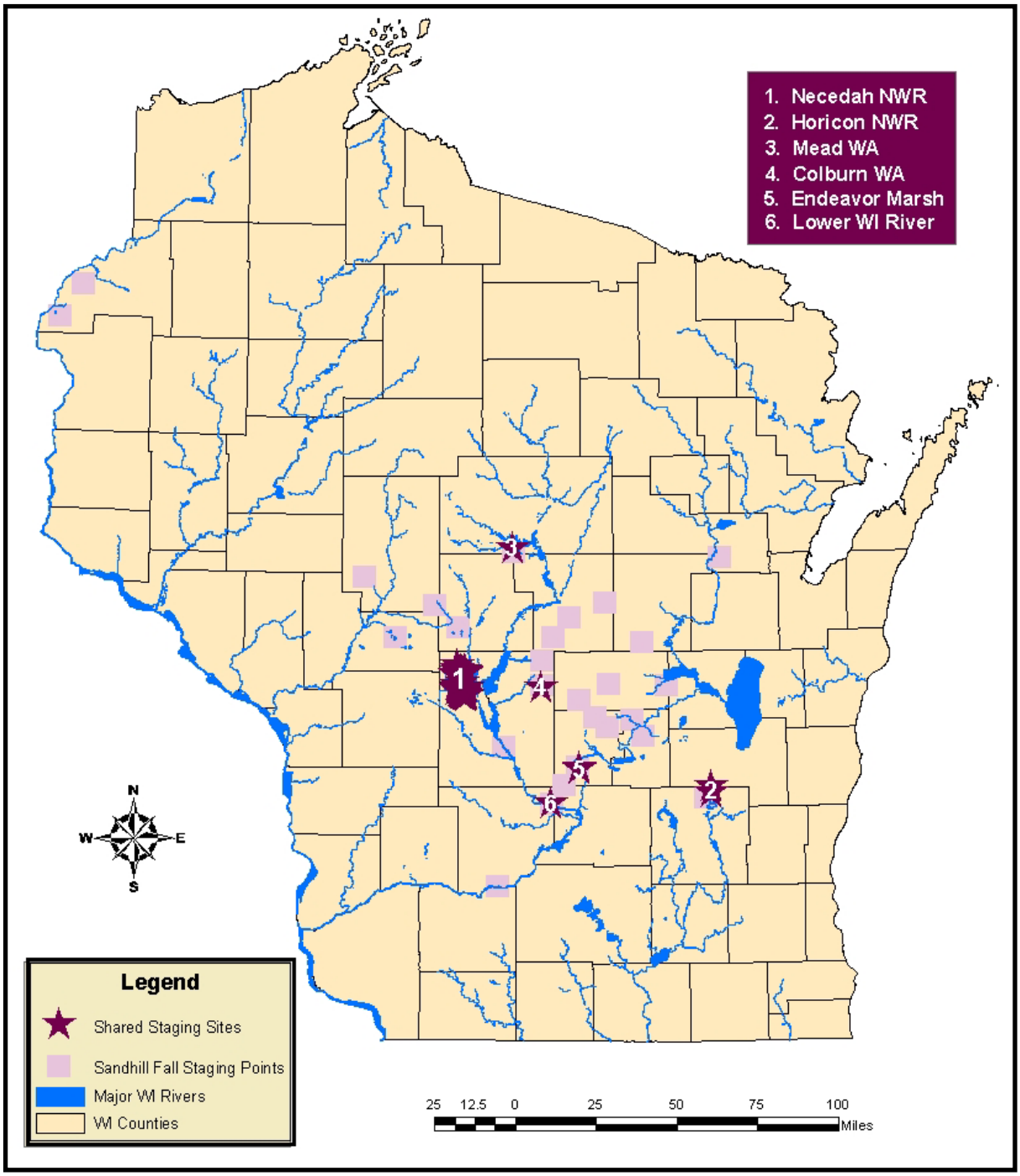

Figure 14. Shared sandhill crane and whooping crane fall staging areas, 2002-2005.

6.8.1 Role of Private Land Management

Whooping cranes depend on wetlands for nesting, chick rearing, and feeding. Wisconsin encompasses almost 34.8 million acres, of which 5.3 million acres are wetlands; 4 million or 75.2 percent of wetlands are privately owned and managed (WI DNR Wetland Team, 2000). Clearly, wetland and grassland habitat restoration on private lands can significantly benefit whooping cranes.

Many government programs inherently aid whooping cranes by providing financial incentives to restore or protect habitat. Examples include the Wetland Reserve Program (WRP) administered by the Natural Resource Conservation Service (NRCS); the Conservation Reserve Program (CRP) administered by the Farm Service Agency; Partners for Fish and Wildlife administered by the USFWS, and; Habitat Restoration Areas administered by the WI DNR. There are also many local options available from non-governmental conservation groups like Ducks Unlimited and the Wisconsin Waterfowl Association.

For instance, the Wetlands Reserve Program (WRP) is a voluntary program to restore and protect wetlands on private property. Landowners receive financial incentives to restore wetlands previously drained for agriculture. For many landowners, WRP makes economic sense. Currently, there are 47,000 acres enrolled in WRP in Wisconsin (USDA, NRCS, 2000).

6.8.2 Property Rights

Some citizens fear the presence of an endangered species on their land could restrict their property rights. Since whooping cranes in Wisconsin are classified nonessential experimental, routine and legal activities on private lands will not put private citizens in conflict with the law. As described in the rule announcing the designation of this whooping crane population, the normal Endangered Species Act penalties would not apply if the " take" of the species was incidental to a legal activity.

At times property rights can be affected by federal agency involvement (i.e., through funding or a permit approval process). To ensure their actions do not jeopardize a species, federal agencies are required to consult with the USFWS under section 7 of the Endangered Species Act. However, under the nonessential experimental designation the section 7 consultation requirement is eliminated, except for actions on National Wildlife Refuges and National Park Service lands. The intentional "take" of the species would still be strictly illegal, whether on public or private lands (See Legal Aspects, Section 4.1).

6.8.3 Agriculture

It is currently unknown whether agricultural crops suffer damage from whooping cranes. To date, whooping cranes tend to be less associated with upland agriculture activities than sandhill cranes. Although less gregarious than sandhill cranes, whooping cranes are sometimes observed in sandhill flocks; therefore, it is possible that they could damage the same agricultural crops. Similarly, it is unknown if agricultural activities (such as application of registered chemicals to cranberry wetlands) are hazardous to whooping cranes, though to be successful, a mutual co-existence will be needed.

Sandhill crane damage to germinating and emerging corn can cause problems for Wisconsin's farmers. Corn plants are vulnerable to crane damage from seed germination until the plant is approximately 8 inches tall. In Wisconsin, this period is usually two to three weeks. Sandhill cranes can also damage potato crops in the central sands region of Wisconsin by probing into the potato hill. The consumption of potatoes is limited, but the probe hole damage to a potato can cause a portion of a crop's yield to be poorly graded. Cranberries are also found in the release area and could be consumed by cranes; however, cranberry crop depredation by sandhill cranes has not been reported.

If crop damage becomes a problem, farmers can discourage crane foraging with non-lethal abatement techniques such as pyrotechnics, propane cannons, high-output

electronic sound, and distress or alarm calls. Chemical deterrents successful towards sandhills include Avitec™', with active ingredient 9, 10 Anthraquinone. This naturally occurring plant substance is a non-water soluble, low-toxicity seed treatment used to repel birds. Under temporary approval by the U.S. Environmental Protection Agency, Wisconsin, Michigan, and Minnesota farmers can apply Avitec™ to prevent corn damage. Cranes are expected to detect Avitec™ at very low levels and avoid treated seed.

Avitec™ use appears to be a win-win solution. The cranes can continue foraging on waste grain and other foods in the field, while the resultant reduction in waste corn and beetle larvae helps prevent problems as crops mature.

If non-lethal techniques fail the landowner may be eligible for a USFWS depredation permit to lethally remove a set number of sandhill cranes. Landowners with sandhill crane depredation permits must be able to differentiate between a sandhill crane and a whooping crane. Technical aid regarding crane damage to agricultural crops can be obtained by calling the U.S. Department of Agriculture (USDA)-Wildlife Services office in Waupun, Wisconsin at 1-800-433-0688.

6.8.4 Invasive Species Control

Prior to European settlement, fire maintained the biological integrity of oak forests, oak savannas, native prairies, and wetlands. Today, land managers and conservationists use prescribed burning to mimic wild land fires. Prescribed burns provide an ecological and economical method of controlling brush and trees. They also limit or eliminate non-native plant growth while stimulating native plant growth. Most invasive non-native plants were brought here intentionally. These species include grassland plants such as leafy spurge (*Euphorbia esula*), wild parsnip (*Pastinaca sativa*), yellow and white sweet clover (*Melilotus officinalis* and *alba*) and Canada thistle (*Cirsium arvense*). Invasive non-native wetland plants include purple loosestrife (*Lythrum salicaria*) and reed canary grass (*Phalaris arundinacea*). The prevalence of invasive non-native species has dramatically increased, threatening ecosystem health through biodiversity loss. Most invasive non-native plants are controlled by burning, cutting, or herbicide application at specific times of the year.

Prescribed burns benefit native landscapes while also helping whooping cranes. Most whooping cranes complete their spring migration to Wisconsin in April; some return in March or May. In the first years of this project, recently burned land provided attractive foraging areas for returning cranes. By timing prescribed burns before or after the cranes return to a specific area, land managers can prevent flushing these birds. Each spring the WI DNR whooping crane coordinator will attempt to alert regional, federal, and state land managers; field biologists, and; county biologists to the locations of whooping cranes in their areas to assist them in planning for prescribed burns. This need for up-to-date reporting of monitoring information underscores the value of the EMP monitoring database. After a prescribed burn, land managers can further assist the reintroduction project by summarizing both the biological outcome and whooping crane use.

6.8.5 Water Level Management

Water level management techniques are used on state and federal lands to enhance habitat for ducks, geese, swans, shorebirds and other water birds (especially at Crex, Mead, and Horicon State and Federal Wildlife Areas). They usually favor whooping cranes because they forage on mudflats and shallows on drawn down pools and

impoundments. If many pools exist in one area, a staggered annual or semi-annual draw down schedule between pools will provide a diversity of food resources along a continuum from deep water to shallow water to mudflat. By slowly lowering the water level, new shallow water sections are created and new mudflat sections are exposed over a greater length of time.
At Necedah NWR, large reservoirs are generally drawn down every third year on a rotational basis such that a draw down occurs somewhere on the refuge almost annually. This provides two years of "full pool" to drown-out encroaching woody vegetation. In the third year, water levels are gradually lowered in mid-May, with a goal of complete reservoir dewatering by June 1. Smartweed, millet, and bidens grow on the exposed mudflats. The reservoir remains dewatered through September 15, when water levels are raised approximately 6 inches every two weeks. This technique continually floods new areas, providing waterfowl access to the millet seed heads and other plants.

In "full-pool" years, reservoir water levels are gradually lowered in early October to concentrate invertebrates for diving ducks. Lowering water levels also creates sandbars. Thousands of sandhill cranes roost on these sandbars, making daily flights off-refuge for feeding.

Water level management at Horicon NWR is similar to that of Necedah, but is usually conducted over a five to seven year period. Following complete draw down the unit is left dry for one or two years, depending on the type of emerging vegetation. Though Horicon has the capability to pump and fill the units after a draw down, the impoundments are normally allowed to fill naturally through a combination of precipitation and inflow.

6.8.6 Airport Safety

Because whooping cranes are large, heavy birds with limited flight speed and maneuverability, collisions could lead to aircraft damage, and death or injury to passengers and people on the ground. Since Wisconsin has such a small population of whooping cranes, conflicts at airports are unlikely. If whooping cranes are frequently observed near an airport they should be encouraged to leave by using harassment techniques. Airport managers can call the USDA – Wildlife Services office in Waupun, WI at 1-800-433-0663 for technical help on dealing with wildlife hazards at airports.

Airports are often issued depredation permits from the USFWS to remove a set number of a given species that are presenting hazards to aircraft In the case of whooping cranes, because it is a federally-listed species, this action would require a recovery permit (section 10A-1A) to harass whooping cranes off the airport operating area.

There is already at least one USFWS permit in effect for this purpose, at Volk Field Combat Readiness Training Center, in Camp Douglas, Wisconsin. Since this permit was issued in July of 2005, there has been no need to disperse any whooping cranes from the airfield vicinity.

6.9 Nest Site and Territory Management

Whooping cranes usually choose nesting sites distant from human activities. However, the management and use of public and private lands for turkey hunting, fishing, camping, birding, hiking, off-road vehicle use, agricultural activities, roadside mowing, construction activities, road maintenance, dog training, biking, boating and other activities can be widespread from April through May. These human activities can disrupt

critical nesting and chick rearing periods. Flushing incubating cranes can expose the eggs to heat or cold; either could lead to embryo death. During the brood rearing stage, frequently disturbed adults may not protect chicks from predators, or find enough food for the young to survive.

Despite significant efforts to avoid undue influence while being reared in captivity, some Wisconsin whooping cranes are at least partially habituated to humans. While it is difficult to predict how tolerant these birds will be to disturbance within their nesting territories, it seems prudent to be cautious in providing protections to nesting birds. Cranes are likely to be most sensitive to disturbance during incubation and the early stages of brood rearing. Based upon nesting bald eagles, disruptive activities require a greater distance from the nest site. For cranes, the recommended strategy is to carefully time the activity and maintain a minimum distance from nesting birds (refer to Buffer Zones, Section 6.9.1).

Domestic pets may pose a threat during nesting or brood rearing. From hatching to fledging, chicks follow their parents as they forage, usually in open grassy areas. Domestic pets could harass or kill flightless chicks in these exposed areas. Targeting educational messages to people near nesting whooping cranes is important as the population expands.

6.9.1 Buffer Zones

Nest sites should be surrounded by a 125 m (±400 ft) buffer (based on Florida sandhill crane research). This distance includes flushing distances (75 m, ±250 ft) and an "awareness zone" that would allow nesting birds to react to disturbance without flushing (Stys, 1997). This distance is probably enough for a few people on foot, but is minimal for highly disruptive activities. The distance needed to avoid disruption from heavy construction or other severe disturbances should be evaluated on a case-by-case basis. However, a good starting point is 1/4 mile, or 400 m (±1320 ft). Cranes usually do not use a nest site more than once, but they will use the same general nesting area in subsequent years if conditions (water levels and vegetation) remain favorable. Therefore, any restrictions put in place should be considered in subsequent years.

Communal roost sites are also vulnerable to disturbances. The recommended buffer distance for communal roost sites is 200 m. Unless habitat conditions become unfavorable, cranes will use the same communal roost site for years. In Florida, some roost sites have been used seasonally for at least 15 years (Wood and Nesbitt, 2001).

6.9.2 Timing Activities to Minimize Human Disturbance

The nesting phenology of whooping cranes in Wisconsin is unclear. Whooping cranes generally arrive from the wintering grounds in March and early April. In 2005 and 2006, whooping cranes laid eggs in early to mid-April. Because of the brief period between arrival and nesting, any nest site protections should start by April 1.

As young cranes become increasingly mobile it may be necessary to extend certain protections. After fledging most buffer protections won’t be needed, except for communal roosting sites. Many activities that were delayed near nesting sites could be resumed in August. The type and scope of the activity should be evaluated on a case-by-case basis. Since cranes migrate south in the fall, a safe period exists from early December through mid-March.

To protect cranes during incubation and early brood-rearing, WI DNR may restrict access to nesting areas by seasonal closure on state property within defined boundaries (1/4 mile recommended) as described in s. NR 45.04(1)b. This would not include closing hunting grounds. Although turkey hunting is the only hunting activity that corresponds to crane nesting periods, the two habitats are unlikely to overlap. Similar protection of nesting sites is encouraged on lands managed by federal, county, and private owners.

6.9.3 Land Acquisition and Habitat Protection

Wetlands are a conservation priority in Wisconsin and crucial to whooping cranes. The potential exists for the state, USFWS, U.S. Forest Service, and county and municipal governments to include whooping crane habitat needs in their land acquisition plans. Wisconsin DNR has an active land acquisition program funded by the state's "Stewardship Program." Over many years, WI DNR has acquired thousands of acres of wetlands. In addition, WI DNR has utilized various federal programs such as the USDA Wetland Reserve Program (WRP), the USFWS North American Wetlands Conservation Act (NAWCA), and the Federal Coastal Wetlands program funding to acquire wetlands. WI DNR plans to continue wetland acquisition in the future through the end of the current Stewardship Program as part of overall land acquisition efforts through 2010. Recently, WI DNR worked with the Wetland Reserve Program, the Madison Audubon Society, and Pheasants Forever to restore two large wetlands in Jefferson and Walworth Counties, each about 2,000 acres. One of the project's goals was to provide whooping crane habitat. Amazingly, after the restoration began, whooping cranes did in fact use these areas.

Several statewide land planning projects identified wetland and upland areas needing protection for recreational activities, wildlife habitat, and water quality. For example, planning under the Upper Mississippi – Great Lakes Joint Venture of the North American Waterfowl Plan prioritizes important waterfowl areas. Application of this plan will provide whooping crane habitat in the state. The Wisconsin Land Legacy Study (Pohlman, Bartelt, Hanson, Scott, & Thompson, 2006) identified many areas of the state that merit increased land protection. Many of the areas in this study include wetland areas and wetland complexes important to whooping cranes in the state. It is important that the future habitat needs of whooping cranes be considered and incorporated into the implementation of this study. Future implementation will involve many private, non-profit and public stakeholders. It will be important to inform these stakeholders how their land protection efforts can benefit whooping cranes, especially when wetlands are involved.

Other studies identify important coastal wetlands along Lakes Michigan and Superior needing protection. Plus, there is growing interest in the state to improve wetland protection and restoration for flood control and groundwater aquifer regeneration.

In addition, most Wisconsin counties and townships are preparing "Smart Growth" land use plans that often define wetland areas as "conservancy zoning" and "green space". Local governments may wish to purchase these lands for public recreation. Some counties have land acquisition budgets and/or seek grants for the state and federal governments. The ability of a county to promote its habitat protection efforts as helping whooping cranes would probably be well received.

As whooping crane habitat preferences become more apparent, it will be helpful to identify wetland types, size, spatial arrangement, and locations that would predict future whooping crane use. The addition of whooping cranes to these ecosystems should

generate even greater interest in wetland protection and restoration among private and public landholders.